Small Mammalian Herbivores Decrease Herbaceous Cover in Shrub Invaded Grassland

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INTRODUCTION

Woody shrub encroachment into arid-grasslands over the last two centuries has negatively affected ranching, soil conservation, and grassland dependent species.

A ubiquitous but understudied force that could be contributing to the suppression of grassland re-establishment is herbivory pressure from native mammals.

STUDY AREA

Lucky Hills is a 10.92 ha sub-watershed of the Walnut Gulch Experimental Watershed, in Cochise County, AZ, which is managed by the USDA-ARS (Figure 1).

Cattle have been excluded from Lucky Hills since 1965, yet much of the sub-watershed remains devoid of herbaceous plant cover (Figure 2).

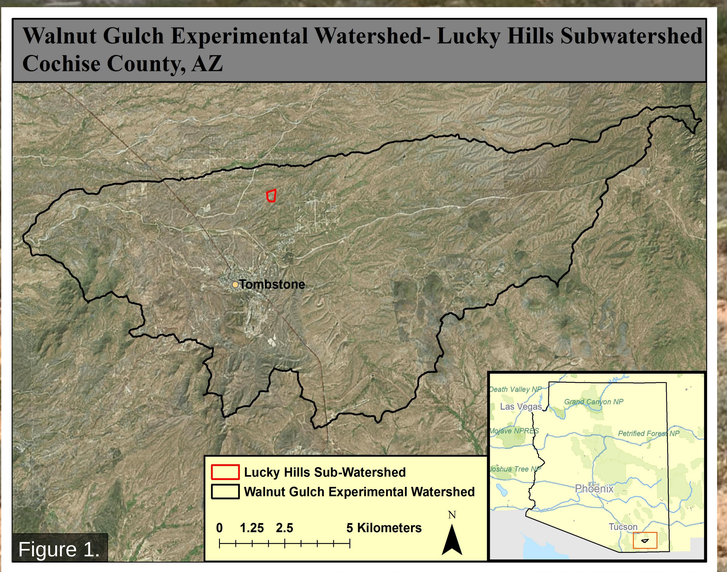

Figure 1.

QUESTIONS

Are native mammalian herbivores suppressing herbaceous plant establishment at Lucky Hills?

If so, which size class of herbivores acts as the greatest deterrent to the establishment of herbaceous growth?


Figure 2.

Lehmann lovegrass (*Eragrostis lehmanniana*) grows abundantly inside long-term herbivore exclosures, but not elsewhere on the site, suggesting biotic forces are responsible for suppressing herbaceous growth across Lucky Hills.

Figure 3.

Motion-activated cameras are associated with each exclosure to record medium and large size mammal presence and visitation rates.

METHODS

We defined three size classes of herbivores: small (e.g. kangaroo rats), medium (e.g. rabbits and jackrabbits), and large (e.g. mule deer).

We built herbivore exclosures and manipulated their entry points to control access by the three mammalian size classes. We included two control levels: 1) “total access” for all mammalian herbivores and 2) “total exclosure” with no access for mammalian herbivores, for a total of 5 treatment levels. Each treatment level was replicated 10 times, for a total of 50 exclosures.

We inventoried the herbivore community through live trapping and the use of motion-activated cameras (Figure 3).

We added 0.1g of Lehmann lovegrass seed to each exclosure to standardize initial herbaceous plant cover.

ANALYSIS

We visually estimated percent herbaceous cover in each exclosure one month after seed application. Estimates ≥5% were binned in increments of 5% cover. Bins <5% included 1% and 0.1% cover.

We ran a two-way ANOVA to detect the effect of treatment levels (exclosure types) and exclosure location on percent herbaceous cover.

RESULTS

We found a significant effect of treatment level on herbaceous plant cover ($F_{4,49}$= 4.54, p=0.004), and a non-significant effect of exclosure location on herbaceous plant cover ($F_{1,49}$= 1.87, p=0.18) (Figure 4).

Our control exclosures allowing “total access” had significantly less average cover (0.1%) than average cover in both “total exclosure” controls (1.68%) as well as large herbivore only exclosures (1.51%).

Average percent cover in exclosures allowing access to small (0.27%) herbivores and small & medium herbivores (0.62%) were intermediate between the two levels of control.

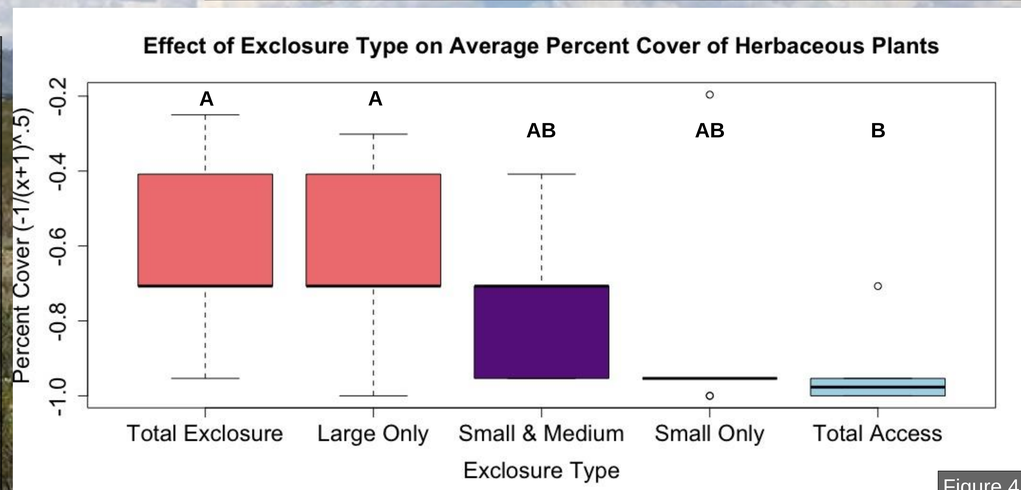

Figure 4.

SIGNIFICANCE OF STUDY

Our project is ongoing, but here we present a preliminary pattern of decreasing herbaceous plant cover with increasing access by smaller-bodied herbivores.

Substantial research efforts have investigated the effects of large-bodied herbivores (both native and domesticated), while few studies have quantified the role small herbivores have in shaping plant community structure.

Our results suggest that small and medium sized native herbivores may contribute to the hindrance of grassland re-establishment. Future efforts to restore grasslands may benefit by considering the impact of herbivory pressure from small and medium sized mammalian herbivores.

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